What is claimed is:

1. In a charged-particle-beam (CPB) microlithography apparatus, a CPB optical system, comprising:

an illumination-optical system situated and configured to direct a charged-particle illumination beam onto a selected region of a reticle defining a pattern to be transferred to a sensitive substrate, the reticle being configured with relatively low-scattering regions and relatively high-scattering regions that collectively define the pattern, the low-scattering regions being transmissive to the illumination beam while causing little to no scattering of charged particles of the beam, and the high-scattering regions being transmissive to the illumination beam while causing comparatively large scattering, relative to the low-scattering regions, of charged particles of the beam; and

a projection-optical system situated downstream of the illumination-optical system and configured to direct a patterned beam, formed by passage of the illumination beam through the selected region on the reticle and carrying an aerial image of a respective portion of the pattern defined in the selected region, to a corresponding location on a sensitive substrate, the projection-optical system comprising a first projection lens situated axially closer to the reticle and having a back focal plane, a second projection lens situated axially closer to the substrate, and a cutoff-plate assembly situated between the reticle and the back focal plane, the cutoff-plate assembly defining an aperture configured to block downstream propagation of at least 90 % of the patterned beam scattered from the high-scattering regions of the reticle.

2. The CPB optical system of claim 1, wherein the cutoff-plate assembly is situated between the first projection lens and the back focal plane.

3. The CPB optical system of claim 1, wherein the cutoff-plate assembly comprises multiple cutoff plates arranged at respective positions along an optical axis, each cutoff plate defining a respective aperture.

4. The CPB optical system of claim 3, wherein a first cutoff plate located closer to the reticle has a larger aperture than a second cutoff plate located downstream of the first cutoff plate.

5. The CPB optical system of claim 1, wherein:

the cutoff-plate assembly comprises multiple cutoff plates each defining a respective aperture; and

the aperture in at least one of the cutoff plates is configured as a slot laterally extended in a beam-deflection direction.

6. The CPB optical system of claim 1, wherein:

the charged particle beam is an electron beam; and

the illumination-optical system is configured to accelerate the illumination beam at a voltage of at least 50 kV.

7. A charged-particle-beam microlithography apparatus, comprising a CPB optical system as recited in claim 1.

8. In a charged-particle-beam microlithography apparatus for transferring a pattern, defined by a reticle including a relatively low-scattering portion and a relatively high scattering portion, from the reticle to a sensitive substrate using a charged particle beam, a projection-optical system, comprising a first projection lens situated axially closer to the reticle and having a back focal plane, a second projection lens situated axially closer to the substrate, and a cutoff-plate assembly situated between the reticle and the back focal plane, the cutoff-plate assembly defining an aperture configured to block downstream propagation of at least 90 % of charged particles of a charged particle beam scattered from the high-scattering regions of the reticle.

9. In a charged-particle-beam (CPB) microlithography apparatus for transferring a pattern, defined by a reticle including a relatively low-scattering portion and a relatively high scattering portion, from the reticle to a sensitive substrate using a charged particle beam, a CPB optical system, comprising:

an illumination-optical system; and

a projection-optical system, comprising a first projection lens situated axially closer to the reticle and having a back focal plane, a second projection lens situated axially closer to the substrate, and a cutoff-plate assembly situated between the reticle and the back focal plane, the cutoff-plate assembly defining an aperture configured to block downstream propagation of at least 90 % of charged particles of a charged particle beam scattered from the high-scattering regions of the reticle.

10. A charged-particle-beam microlithography method in which a pattern, defined by a reticle including a relatively low-scattering portion and a relatively high scattering portion, is transferred from the reticle to a sensitive substrate using a charged particle beam, the method comprising:

directing a charged-particle illumination beam to a selected region on the reticle including the relatively low-scattering portion and the relatively high-scattering portion so as to produce a patterned beam, propagating downstream of the reticle, containing charged particles that have been scattered by passage through the high-scattering portion;

directing the patterned beam through a projection-lens system to a selected corresponding region on the sensitive substrate, the projection-lens system including a first projection lens situated downstream of the reticle and having a back focal plane, and a second projection lens situated downstream of the first projection lens; and

as the patterned beam is directed through the projection-optical system, blocking downstream propagation of at least 90% of the charged particles that were scattered by passage through the high-scattering portion, the blocking being performed at a location between the reticle and the back focal plane.

11. The method of claim 10, wherein the blocking step is performed using a cutoff-plate assembly located between the reticle and the back focal plane, the cutoff-plate assembly comprising at least one cutoff plate arranged at a respective position along an optical axis of the projection-lens system, the cutoff plate defining a respective aperture.

12. A method for manufacturing a microelectronic device, comprising a microlithography step performed using a charged-particle-beam microlithography apparatus as recited in claim 7.

13. A method for manufacturing a microelectronic device, comprising a charged-particle-beam microlithography method as recited in claim 10.